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NOTES ON PISSODES TERMINALIS, HOPPING IN
IN CALIFORNIA LODGEPOLE.

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Berkeley, California
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Since Hopping (1) described the lodgepole terminal weevil, (Pissodes terminalis) as new and gave the important points concerning its distribution, habits and injury, very little attention has been given this insect or to the damage it causes to immature lodgepole in California. Keen (2) mentioned the species but briefly and but few specimens of adults are to be found in entomological collections. Practically no attention has been paid to problems that may arise as the use of lodgepole areas, either for pole and tie supplies or in connection with recreation, is developed.

It is probable that lack of interest in the future of lodgepole areas in California is due largely to the low intrinsic value of the timber. However, the increasing use of many areas in the National Forests and National Parks in which lodgepole is the predominant tree species for recreational use makes consideration of the possible reduction of values through insect injury of importance. This is emphasized when it is considered that many of the areas now bearing pure lodgepole stands apparently are not suited for the production of heavy cover of other endemic tree species.

LODGEPOLE PINE IN CALIFORNIA

It is stated by Sudworth (3) that the species Pinus contorta Loudon is extremely variable in form. The coast type, which is to be found along the coast range in the northwestern portion of the state is low and bushy. The high Sierra and Rocky Mountain type of lodgepole usually is taller, grows in denser stands, and the individual trees have smaller crowns and long, straight boles. This type of lodgepole is that reported by Hopping to be infested and the type on which our observations have been made.

Lodgepole does not reproduce heavily, except following fires, in which case nearly pure, even aged stands are produced. However, natural reproduction does take place without the aid of fire, within the cover of older trees, or around the margins of openings. This type of reproduction produces the uneven aged stands

1. Hopping, Ralph. A New Species of the Genus Pissodes (Coleoptera) Can. Ent. 52: 132-134, 1920
2. Keen, F.P. Insect Enemies of California Pines and Their Control. Bul. 7, Calif. Dept. Nat. Res., Sacramento, 1928.
3. Sudworth, G.B. Forest Trees of the Pacific Slope. pp49-54, 1908.

which are to be found in most places where some catastrophe has not occurred. There is a distinct difference between the intensity of infestation of immature trees growing in the open, even aged stands and trees of the same age growing in uneven aged stands containing mature individuals.

INJURY CAUSED BY THE LODGEPOLE TERMINAL WEEVIL

Type of Injury.

As noted by Hopping, the larvae mine through the pith of the terminal (Figure I) killing it down to and often including the first whorl of branches. From one to six adults may emerge from a single infested terminal. The writer's observations have corroborated Hopping's statements. In addition notes have been made on the habits of attack and effects of the injury caused by the weevil.

Attack and oviposition by the parent adult results in pitch flow (Figure II) and attack may take place on any portion of the leader at or above the first whorl of branches. In but a few instances attack has been found below the branch whorl. More than one attack may occur on a single leader. Pupation is in the infested leader in the late summer or fall, and each individual lies in a separate cell in the pith. Each emerging adult apparently makes its own emergence hole (Figure III).

Effects of Injury.

Although not all attacks are successful, the injured leader usually dies and remains on the tree as a dead stub. Lateral branches of the first whorl below the lower limit of the dead leader then take over the functions of the leader. Usually one becomes the more vigorous although as many as three distinct primary leaders have been seen to have developed after a single attack. The resultant injury is malformation of the bole, either by the production of more than one primary leader, or at the least by production of a distinct crook in the main stem. Attacks on laterals are not as important in producing malformation of the tree proper although, of course, the production of a low, bushy type tree is the final result of all attacks.

The greatest injury that has been noted on immature trees, still subject to attack, has been the formation of the usual bushy form and production of three main boles, two of which had forked again as the result of attack when the tree had reached a height of about ten feet. Notice of this injury raises the question as to how much of the malformation that has been noted in lodgepole stands in California has been caused by attacks by the terminal weevil. Previously these

malformations, chiefly resulting in a multiple-boled, bushy type of tree, have been attributed to environmental conditions on what may be considered marginal sites, or explained by the belief that the stands were of the coast type lodgepole rather than of the Sierra type. It is possible that, in some areas now suffering from epidemic infestations in immature trees, the malformed mature trees are, to a large extent, the final result of weevil injury.

In the Medecine Lake area in the Shasta National Forest, for example, there are two distinct types of lodgepole stands, each growing under the same environmental conditions. One type is a mature forest, dense, tall and straight, with reproduction only in openings or in the area recently practically denuded of mature trees by mountain pine beetle epidemics. The other type is an open stand consisting of islands of mature, malformed trees and extensive areas of immature, heavily infested and bushy trees. The malformations of the mature trees are typical of those now evident in the immature trees and consist of crooked and forked boles.

There is no evidence giving any explanation of the differences in density of stand of the types in the Medecine Lake area although there is evidence that the open stand has, in the past, been much denser and was mature over the entire area. This mature stand apparently was destroyed by bark beetle epidemics in which some few islands of timber survived. The insect losses were followed by a fire.

CONDITIONS IN INFESTED AREAS

Immature trees up to 25 feet in height have been found infested, but no recent injury has been noted on mature trees. Hopping noted epidemic infestation near Chester in open, immature, even aged stands, the trees of which now are about twenty feet in height. He also recorded the distribution of the insect as from Kern to Lassen Counties.

Epidemic infestations have been found in even aged immature lodgepole at Medecine Lake, Shasta National Forest and Hat Creek, Lassen Volcanic National Park in addition to the Chester area of the Lassen National Forest.

Catastrophic disturbances in at least two of these areas resulted in the formation of the even aged stands - in the Shasta, mountain pine beetle infestation followed by fire - in the Lassen Park, a volcanic disturbance. The type of stand now present on the Park area is illustrated by Figure IV, in which is pictured an open stand of reproduction of a squat and bushy type.

Attack in this area has been extreme. Often several attacks have followed one another in successive years. Figure V shows a typical specimen with a terminal attack in 1927 (1) which resulted in the formation of a fork and secondary terminal (2). A second terminal attack in 1929 (3) resulted in the formation of another secondary leader (4). Another terminal attack in 1932 (5) resulted in the formation of two secondary leaders, the tips of each of which were infested in 1933 (6).

Infestations were also found in lodgepole areas in the Lassen National Forest, at Murdock Crossing in the Plumas, Donner Lake in the Tahoe, Silver Lake in the Eldorado, and Snow Flat and Perego Meadows in the Yosemite National Park. In all of these areas the immature trees resulted from natural reproduction and not from catastrophes as in the areas in which epidemic infestations exist. The stands are uneven aged and the injuries caused by the infestations are of a minor nature. Typical infestation is illustrated by Figure VI. But one or two attacks occur on any tree over a period of years and a relatively high percent of the susceptible material shows no indication of recent or old injury.

From observations that have been made it is very evident that the infestation in natural production and uneven aged stands is relatively innocuous, probably because of environmental conditions and the presence of a limited amount of suitable host material. Contrarily infestation in open even aged stands is of great importance and results in considerable injury.

FIGURE I



FIGURE II



FIGURE III

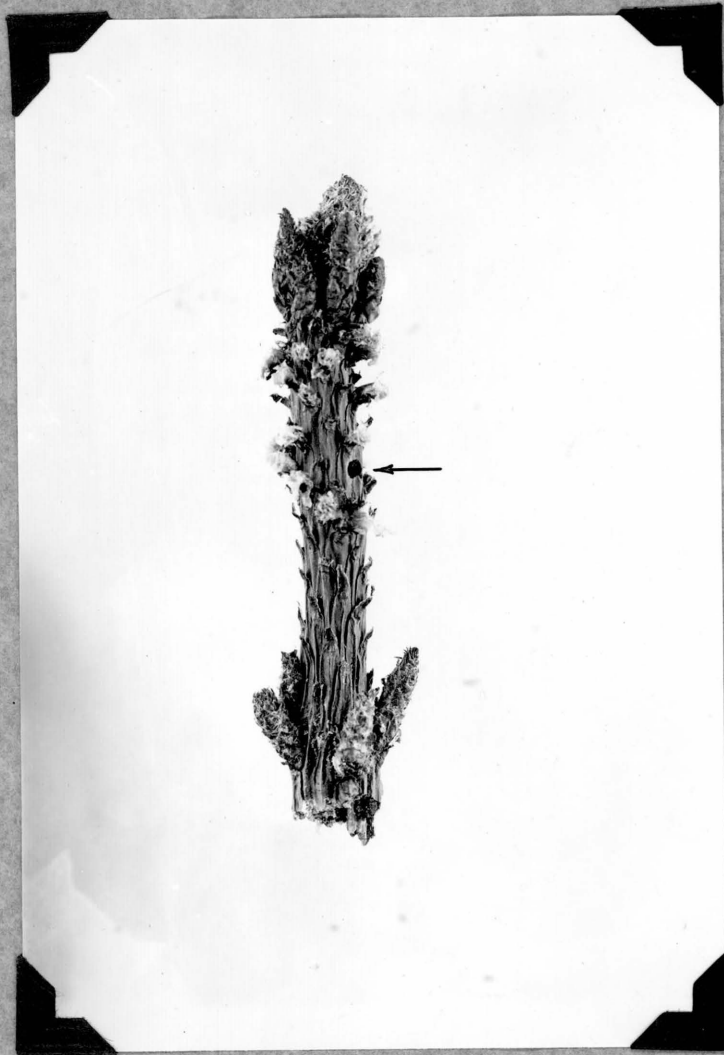


FIGURE IV



FIGURE V



FIGURE VI

